Knowing the Ocean World

1. Science and the Story of the Ocean

--Science uses the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (a systematic way of asking and answering \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ about the natural world), \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

--Curiosity about the ocean led to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and finding food more easily. The search for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ came later.

1. An Ocean World

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ -the vast body of saline water that occupies the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of Earth’s surface.

--4% of humanity’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, 1/3 of all \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ come from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--Nearly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ people live within \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of ocean

--Terms \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ used for human convenience, there is really \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ world ocean (covers \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ % of Earth’s surface)

--Ocean facts: covers 361 million square km (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_), avg. depth is 3,796 m (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_),

seawater vol. 1.37 billion km3(329 mi3), avg. temp. 3.9°C (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

--the average depth of the ocean is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the average height of the continents above sea level.

--Of all water on Earth, only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ % is fresh, and of the freshwater, only 30% is free to use (the rest is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ only make up less than \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ % of all water on the planet.

1. Marine Science, Oceanography, and the Nature of Science

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (the process of discovering unifying principles in data obtained from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, its associated \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and the bordering \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_); also called oceanography.

--Integrates the 3 main sciences: \_\_\_\_\_\_\_\_\_\_\_ Science, \_\_\_\_\_\_\_\_\_\_\_\_ Science, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Science

--Using the scientific method, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ becomes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ through much \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is collected, and the best possible \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are applied to new \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

1. Early Voyaging and Discovery

--The fact that early explorers met “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_” everywhere they went, shows that the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ did not slow the spread of man from early evolutionary times.

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ were the first to use water travel as a means of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1200 BC) in the Mediterranean

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ moved into open ocean around 900-700 BC, thought it was a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (*okeanos*), didn’t sail out of sight of land

--800 BC, first \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (chart makers) map \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--Charts = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, maps = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--Used \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ position for navigation

1. Science for Voyaging

--Library of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ founded \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ century BC by Alexander the Great

--Greatest storehouse of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ knowledge

--Docked ships turned over any \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to be copied, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ were kept in the library

* 1. Alexandrian Contributions

--Around 200 BC, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ calculated the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the Earth to within 8% using angles of sunlight at noon on the longest day of the year.

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ hypothesized that the Earth was round in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ century.

--library was first real \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--researchers shared information and came up with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (finding your position on Earth by stars, planets, the moon, and the sun)

--charts were kept and updated in the library until its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ were invented by Eratosthenes

* 1. Latitude and Longitude

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ perfected latitude and longitude by dividing into \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--Ptolemy divided the degrees into \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--Latitude = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, longitude = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--latitude 0 at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, goes up 30, 60, 90 north and 30, 60, 90 south

--longitude 0 originally at Alexandria, later moved to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, England because the British were known for excellent sailing prowess and impeccable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--longitude moves \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from 0 up to 180 and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from 0 up to 180

* 1. Voyages of the Oceanian Peoples

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ colonized 10,000 Pacific Islands starting 30,000 years ago.

--Main islands colonized by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ BC

--Between 300 and 600 AD, Polynesian people spread out from the main islands to nearly every inhabitable island in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sq.mi. area of ocean all the way to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Meanwhile, Back in Europe

--The fall of the Alexandrian library led to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in Europe

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ attacked the Europeans with superior sailing skills until the Europeans perfected their \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--Vikings found \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ when blown off course looking for easier raids

--Vikings colonized Iceland by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ AD, Greenland by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ AD

--Accidentally found the North American coast in 986 by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Greenland

--Called Newfoundland \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, because of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ they found

--settled Vinland in 1000 AD, abandoned in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Contributions

--Dark Ages did not affect \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--between 1405 and 1433, they sent 300 ships exploring the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and around the tip of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ just to show off their power

--invented the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ compartments, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ systems

--Chinese quit ocean exploration in 1433 due to changes in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ beliefs

* 1. The Age of Discovery: From Prince Henry to Magellan

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ended the Dark Ages, ushered in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--Constantinople captured by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in 1453, cutting off overland \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ trade

--Ocean exploration sought water routes to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--Prince Henry the Navigator was from the royal house of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--set up a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for marine science and navigation

--didn’t sail much himself, but sent out many \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--started using the compass secretly, Europeans still thought it was \_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--Christopher Columbus-credited with discovering North America, even though \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ were already here.

--Ferdinand \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ -credited with being the first explorer to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the globe, even though he \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ before the end of the trip

1. Voyaging for Science

--After the Age of Discovery, \_\_\_\_\_\_\_\_\_\_ sea power arose to compete with \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_.

--Admiral de Bougainville of France sailed into the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the mid-1760s and claimed \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in 1768. This opened the door for European nations in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

* 1. James Cook

--British Royal Navy, commander of many missions for the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ circling the world, looking for new \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, searching for a northwest passage above North America, first known for voyaging just for the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. The Longitude Problem

--Latitude could be calculated using the stars, but \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ needed a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to go by. Pendulum clocks of the time were \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on ships.

--John Harrison, in 1728, invented the first \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, driven by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ instead of pendulums.

* 1. The Sampling Problem

--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the sampling line made noting location difficult, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the line made it difficult to know when you hit bottom, sampling was \_\_\_\_\_\_\_ consuming and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

--Sir John Ross and nephew designed a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sampler in 1818 that was much more reliable, they also took reliable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (depths) of the ocean floor

--Fridtjof Nansen perfected the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ near the end of the1800s, it is still named after him, sampling at depth still remains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. The First Scientific Expeditions
   1. The United States Exploring Expedition

--The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Institution used the United States Exploring Expedition as the nucleus of its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ collection.

* 1. The Work of Matthew Maury\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. Charles Darwin and HMS *Beagle\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
  3. The Rise of Modern Sea Power
     1. Alfred Thayer Mahan\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  4. The *Challenger* Expedition

--*Challenger*-the first “\_\_\_\_\_\_\_\_\_\_\_\_” science expedition, used the term \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the first time

1. Voyages for Science in the Twentieth Century
   1. Polar Exploration \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. Marine Archaeology(--read about this topic on p.27)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Other Twentieth-Century Voyages

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1. The Rise of Oceanographic Institutions

--Future research will be done through \_\_\_\_\_\_\_\_\_\_\_\_, institutional, and national oceanographic institutions.

1. Satellite Oceanography

*--TOPEX/Poseidon*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Alphabetic Oceanography

*--Glomar Challenger\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

1. History in Progress

--Current research is funded through academic institutions or governmental agencies, usually \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ funded.